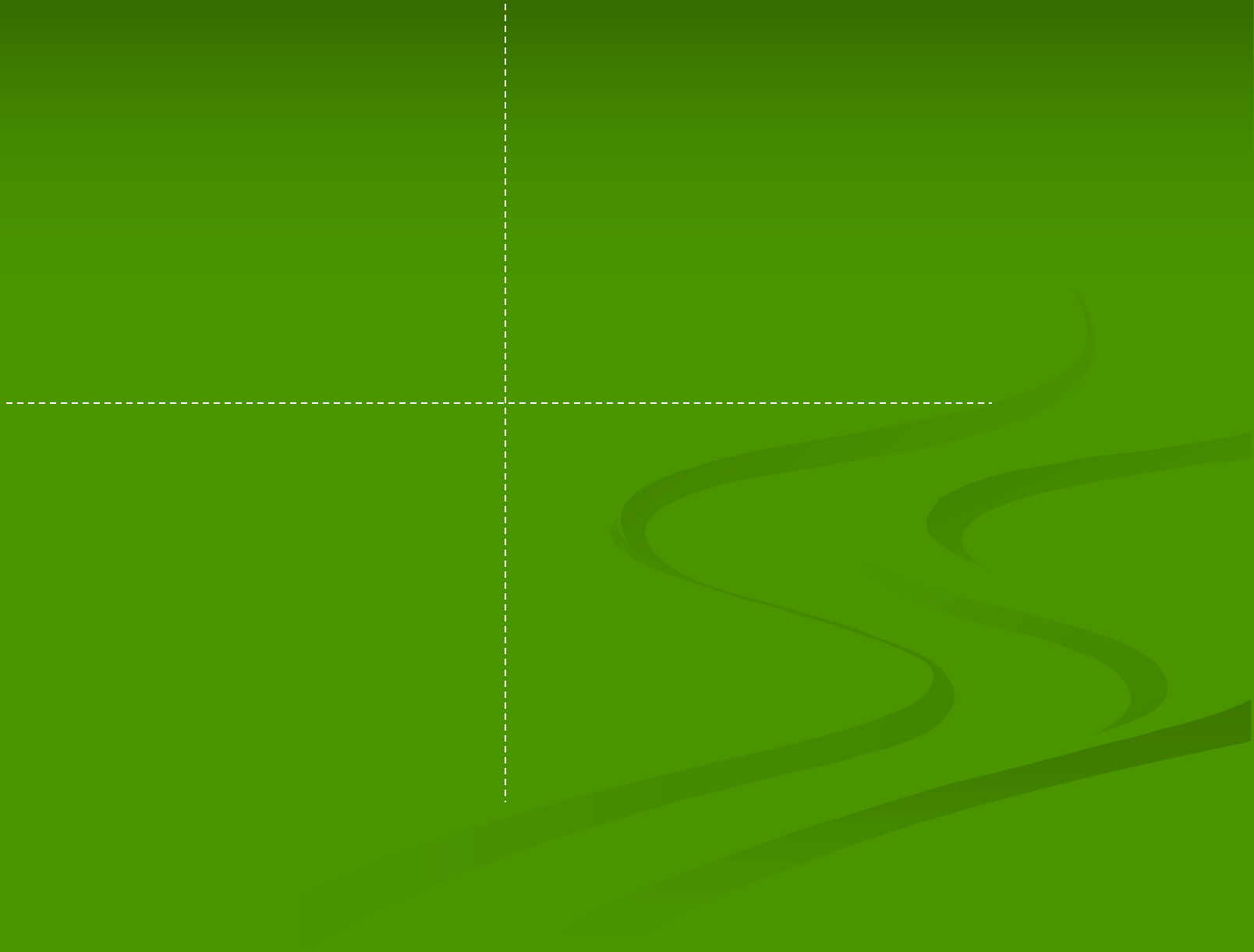


The Sinking Ship

- You again are on duty at Coast Guard HQ when you get a distress call from a sinking ship. Your radar station locates the ship at range 17.3km and bearing 136° clockwise from north. You also locate a rescue boat 19.6km 153° clockwise from north. You need to radio to the captain of the rescue ship the distance and course (direction) needed to travel in order to rescue the members of the sinking ship.



The Sinking Ship



Lesson #13

Topic: Drawing and Adding Vectors

Objectives: (After this class I will be able to)

1. Split diagonal vectors up into (x) and (y) components
2. Find the magnitude of a resultant vector given the x and y components of that vector

Warm Up: Your flight takes off in Pittsburg and flies with a constant speed of 350 km/h towards Chicago which is 600km away. The plane experiences a 50 km/h headwind throughout the entire trip. How long does it take you to get to Chicago?

Assignment: “Adding Vectors” due tomorrow

Your flight takes off in Pittsburgh and flies with a constant speed of 350 km/h towards Chicago which is 600km away. The plane experiences a 50 km/h headwind throughout the entire trip. How long does it take you to get to Chicago?

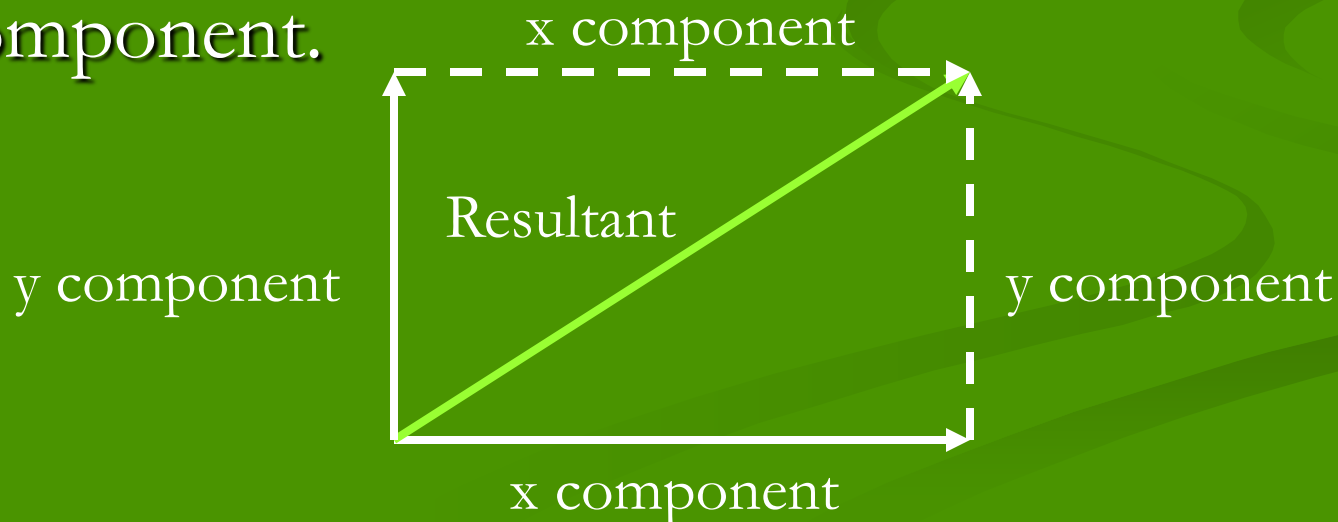
1. 1.71 hours
2. 12 hours
3. 2 hours
4. 1.5 hours

Drawing and Adding Vectors

- Only vectors with the same units can be added.
- Vector Diagrams are used to assist in combining vectors.
- Vectors are represented with arrows to show their direction.
- Vectors in the same or opposite direction can be simply added or subtracted.
- Vectors perpendicular to one another must be combined using Pythagorean Theorem.

Drawing and Adding Vectors

- Horizontal and vertical pieces are **components** of an overall **resultant** vector.
- Component Vectors are drawn completely in the x or y direction.
- Resultant vectors are drawn from the tail of the first component to the head of the last component.



Which of the following statements is False?

1. Vectors are represented with arrows.
2. Vectors in opposite directions are subtracted from one another.
3. Vectors perpendicular to one another are added.
4. Two or more **components** make up a **resultant** vector

0% 0% 0% 0%

Vectors are represent...

Vectors in opposite d...

Vectors perpendicula...

Two or more compon...

Vector diagrams:

- Example 1: A dog walks 20m east, stops and then walks 10 more meters east. What is the dog's displacement?
- Example 2: A dog walks 40m east, stops and then walks 10 m west. What is the dog's displacement?

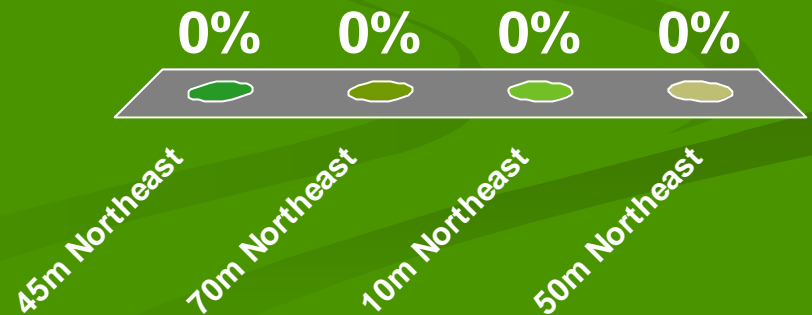
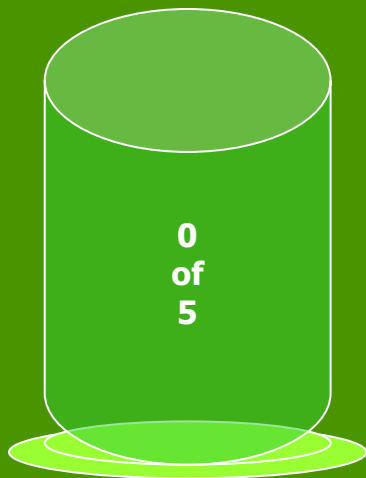
Project

- Walk in one direction, then stop and walk in a 90° different direction.
- Have someone measure your distance traveled in each direction and total displacement traveled.
- Record all your measurements.

Distance 1	Distance 2	Displacement

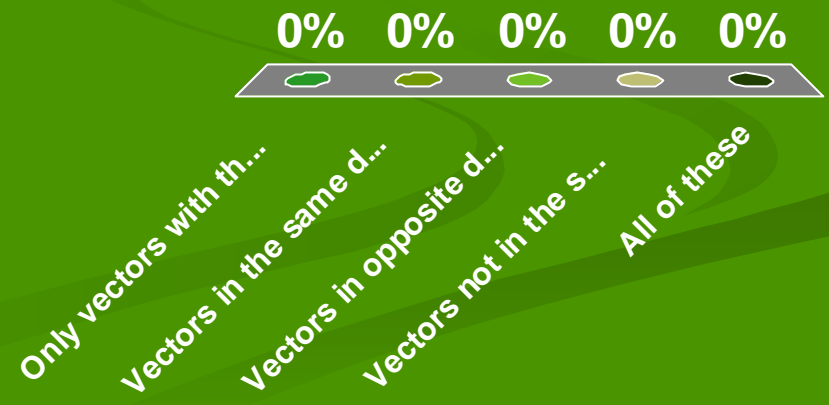
Example 3: A dog walks 40m east, stops and then walks 30 more meters north. What is the dog's displacement?

1. 45m Northeast
2. 70m Northeast
3. 10m Northeast
4. 50m Northeast



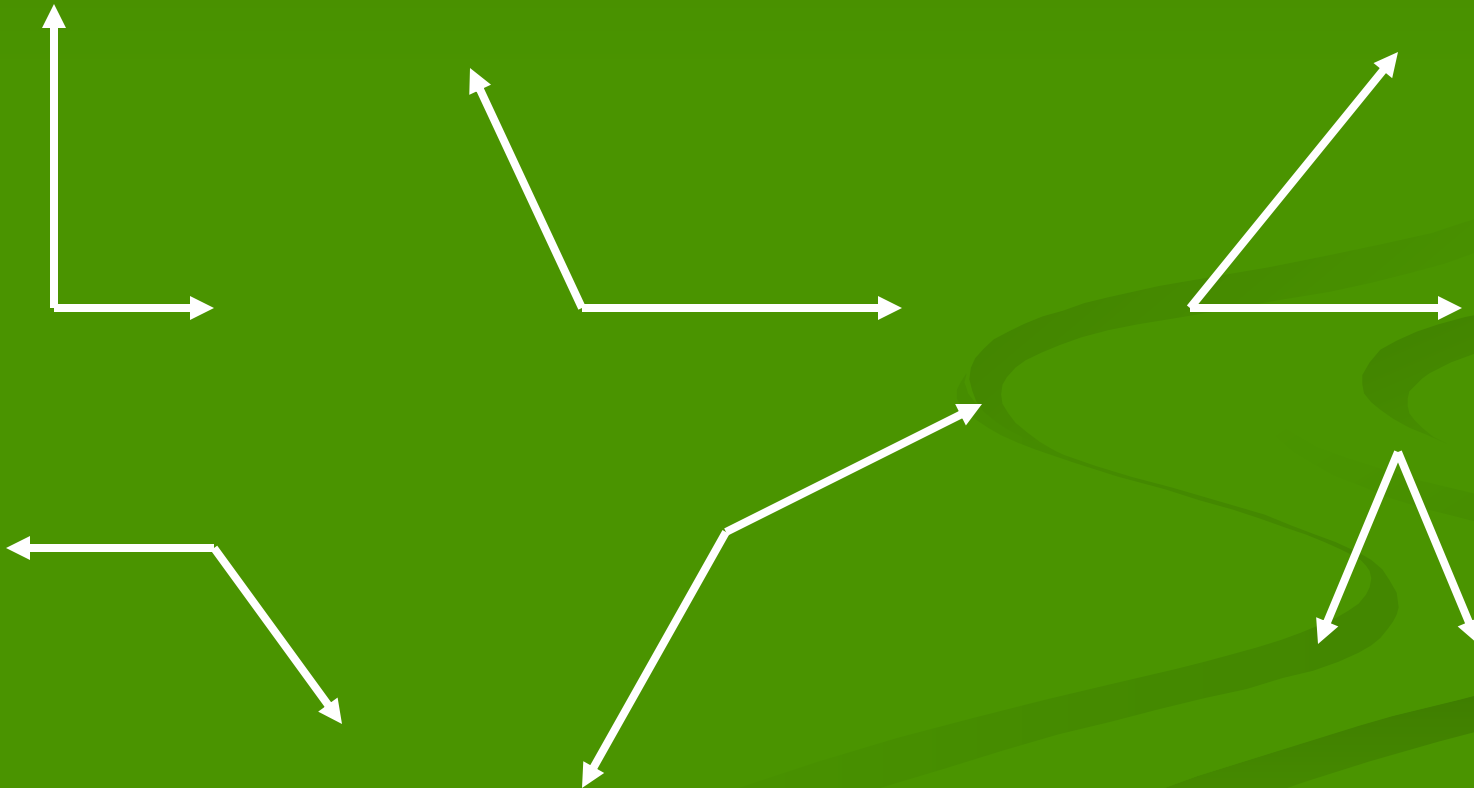
Which of the following is true?

1. Only vectors with the same units can be added.
2. Vectors in the same direction are simply added.
3. Vectors in opposite directions are subtracted.
4. Vectors not in the same or opposite directions need a triangular vector diagram.
5. All of these



Parallelogram rule

- Use the parallelogram rule to draw the resultant vectors for the following diagrams.



Lesson #14

Topic: Trigonometry

Objectives: (After this class I will be able to)

1. Use trig functions and angles to find an unknown side of a triangle.
2. Label unknowns with appropriate variables

Project: Walk a few meters towards 45° NE. Have a partner measure your displacement. How far East did you walk? How far North did you walk?

Assignment: “SOH CAH TOA” due tomorrow
“Angles and Vectors” due Wed

Trigonometry

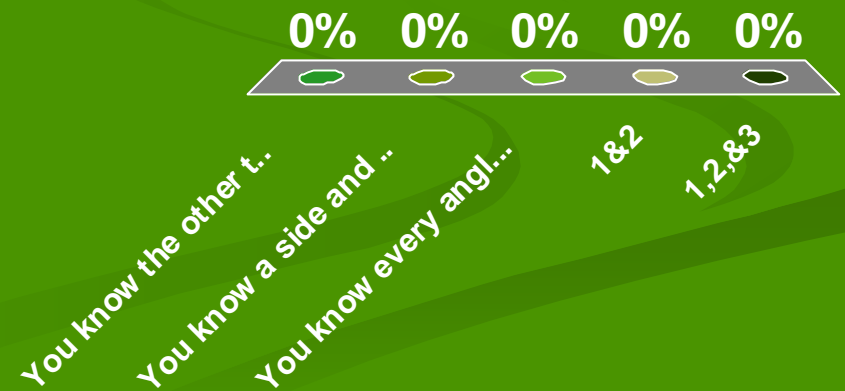
- Solving for unknowns using right triangles
- If you know 2 sides of a right triangle you can solve to find the unknown side and the unknown angles
- If you know a side of a right triangle and an angle you can find the other 2 unknown sides
- Trig functions can be found on any scientific calculator (which you definitely need to have).

SOH CAH TOA

- Sine, Cosine, and Tangent are the ratios of the lengths of two sides of a right triangle for any given angle.
- You tell the calculator the angle, it tells you the appropriate ratio.
- θ = variable for an angle
- Works only for right triangles
- $\sin(23^\circ)$ does **not** mean $\sin * 23$
- \sin , \cos , and \tan are a new type of function

You can solve for a side of a right triangle if...

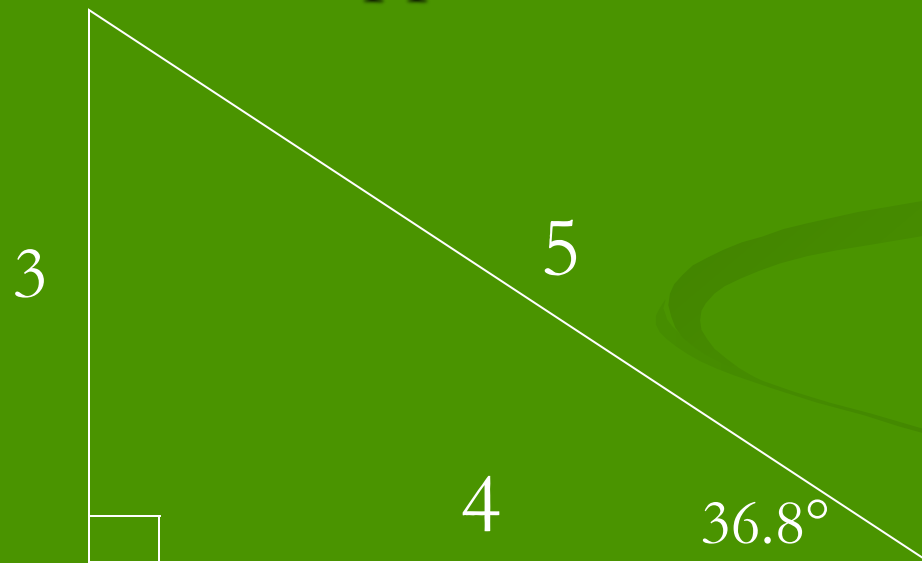
1. You know the other two sides
2. You know a side and an angle (besides the 90°)
3. You know every angle but no sides
4. 1&2
5. 1,2,&3



SOH CAH TOA

- SOH – $\sin \theta = \text{Opposite side} / \text{Hypotenuse}$
- CAH – $\cos \theta = \text{Adjacent side} / \text{Hypotenuse}$
- TOA – $\tan \theta = \text{Opposite side} / \text{Adjacent side}$

Example:



$$\sin(36.8^\circ) = \frac{3}{5}$$

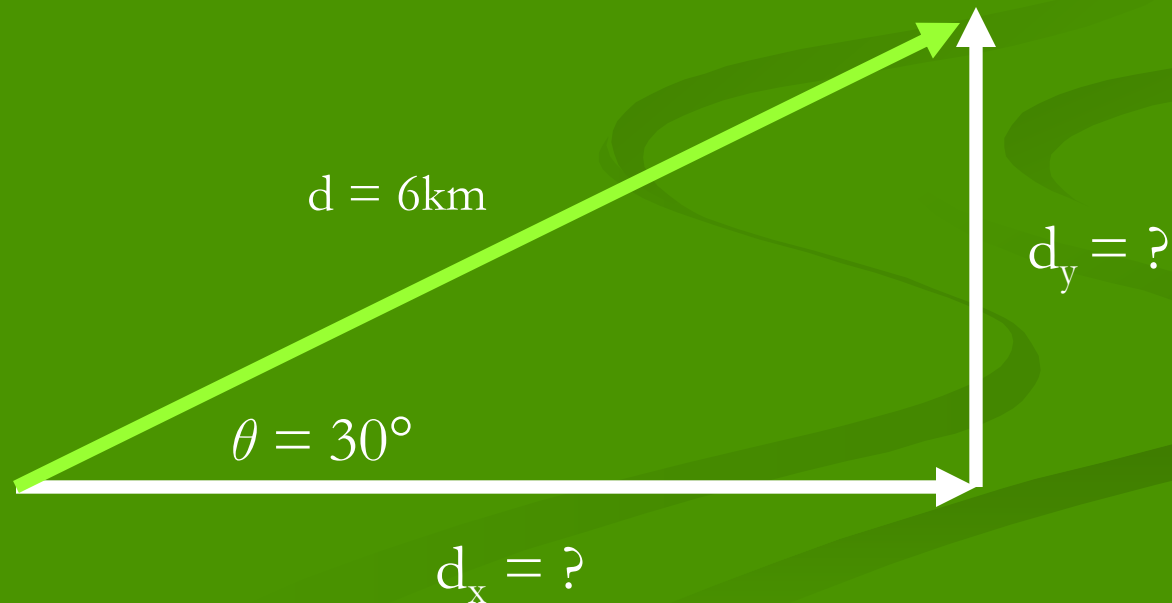
$$\cos(36.8^\circ) = \frac{4}{5}$$

$$\tan(36.8^\circ) = \frac{3}{4}$$

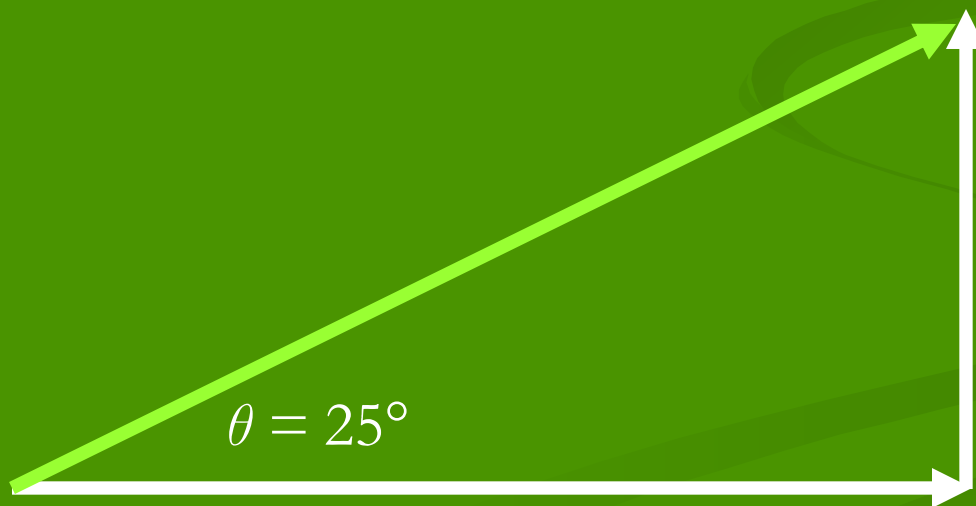
Practice Problem

Joe walks 6km at 30° North of East. Create a vector diagram of Joe's path and draw and label the x and y components of his displacement.

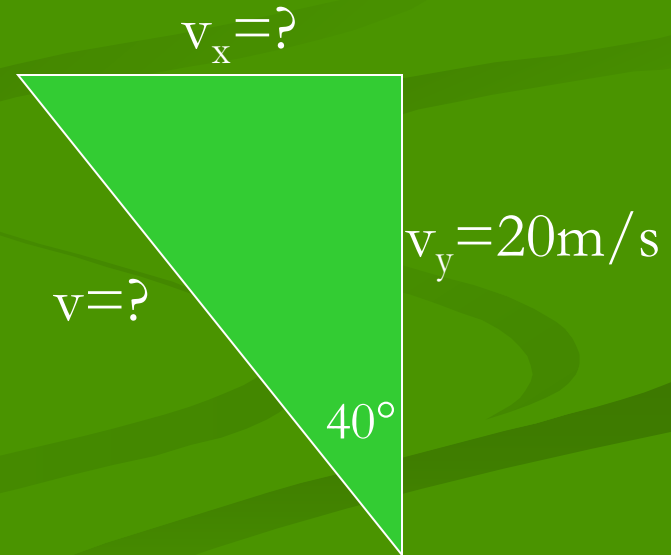
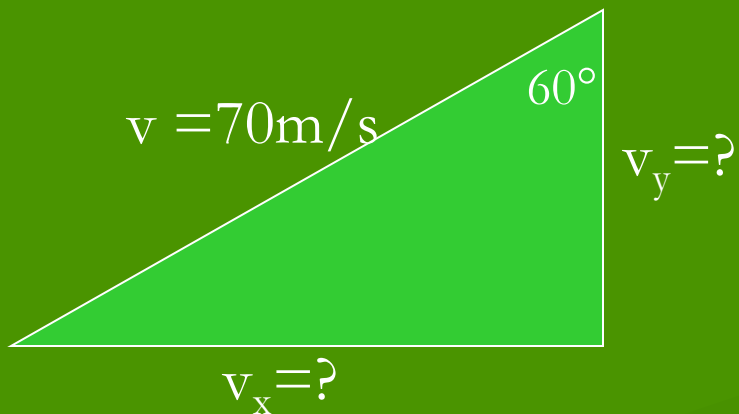
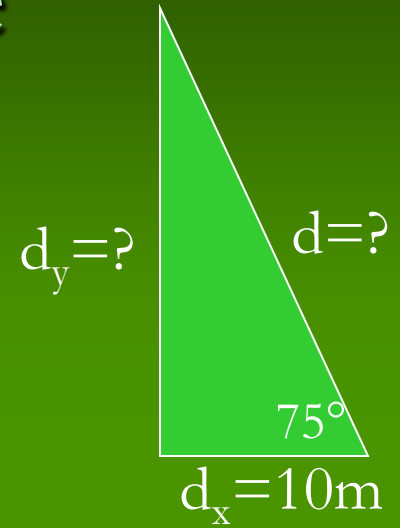
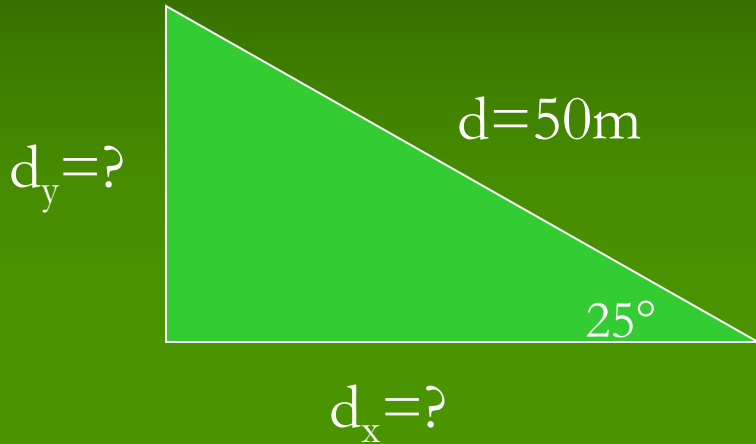
- How far east did Joe travel?
- How far north did Joe travel?



Practice Problem



Trig Practice



Practice Problems

1. Steve sails his boat with a velocity of 15m/s at 40° S of W.

Solve for the south and west components of his velocity.

2. A cannon ball is fired with an initial velocity of 650m/s at a 40° angle above the horizontal. What are the x and y components of the initial velocity?

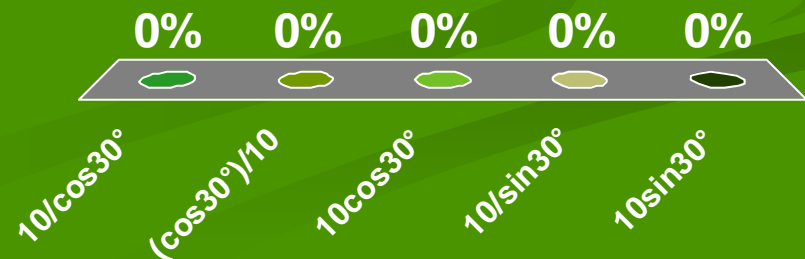
Practice Problems

3. Sarah is flying her airplane 60° East of South. The wind is blowing 12m/s toward the East. What is the speed of Sarah's airplane?
4. Frank goes for a jog. He heads in a direction 40° East of North. After 3 minutes he is 400m North of where he began. What is Frank's speed?
How far East has he traveled?

The adjacent side of a 30° angle of a right triangle is 10. What is the hypotenuse?

1. $10/\cos 30^\circ$
2. $(\cos 30^\circ)/10$
3. $10\cos 30^\circ$
4. $10/\sin 30^\circ$
5. $10\sin 30^\circ$

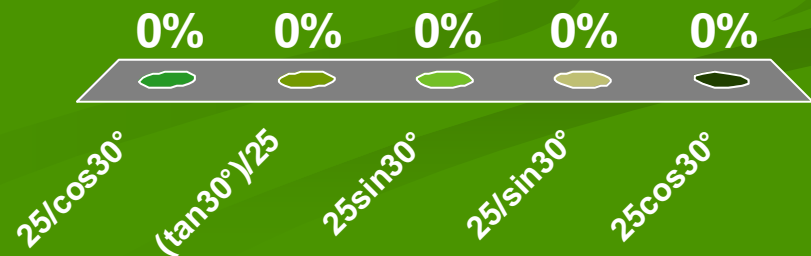
0 of 5



The hypotenuse of a 30° angle of a right triangle is 25. What is the opposite side?

1. $25/\cos 30^\circ$
2. $(\tan 30^\circ)/25$
3. $25\sin 30^\circ$
4. $25/\sin 30^\circ$
5. $25\cos 30^\circ$

0 of 5



Lesson #15

Topic: Vectors and Angles

Objectives: (After this class I will be able to)

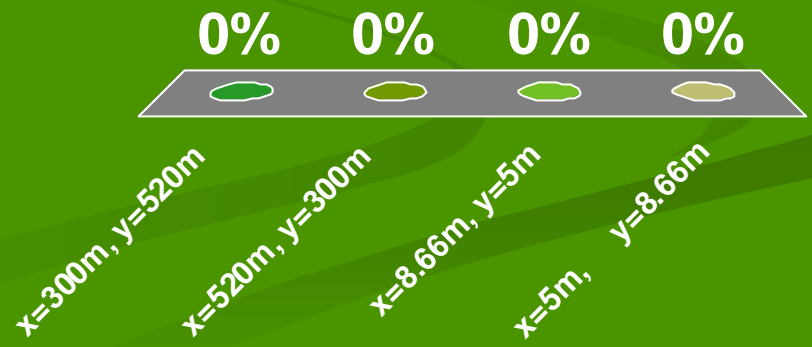
1. Solve for an unknown angle given two components of a right triangle.

Warm Up: Jane walks at 60° North of East with a speed of 2m/s for 5 minutes. Create a vector diagram of Jane's path and solve for the x and y components of her displacement.

Assignment: New Wikispaces post
Exam 2 Review Due tuesday!

Jane walks at 60° North of East with a speed of 2m/s for 5 minutes. Create a vector diagram of Jane's path and solve for the x and y components of her displacement.

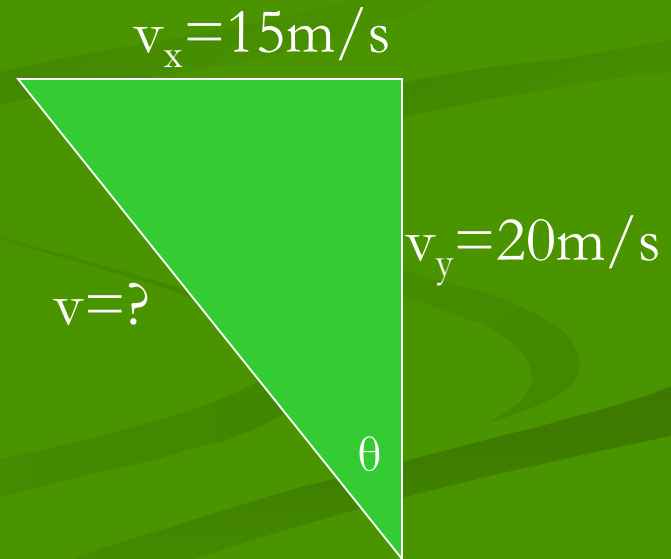
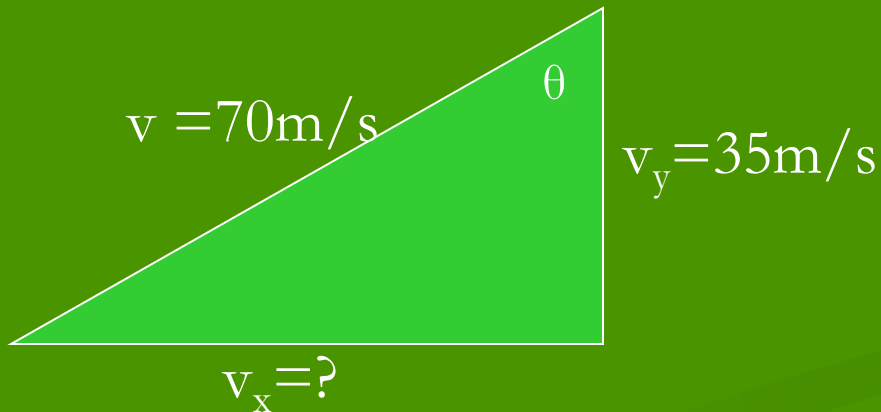
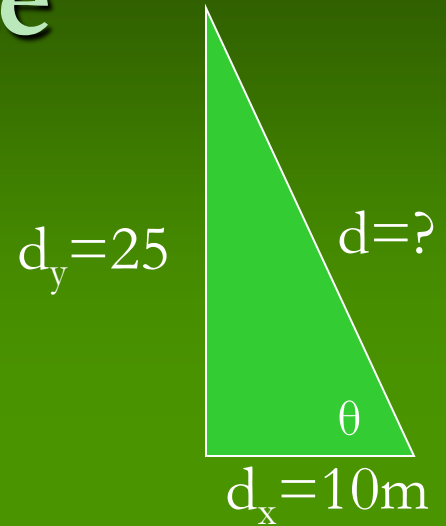
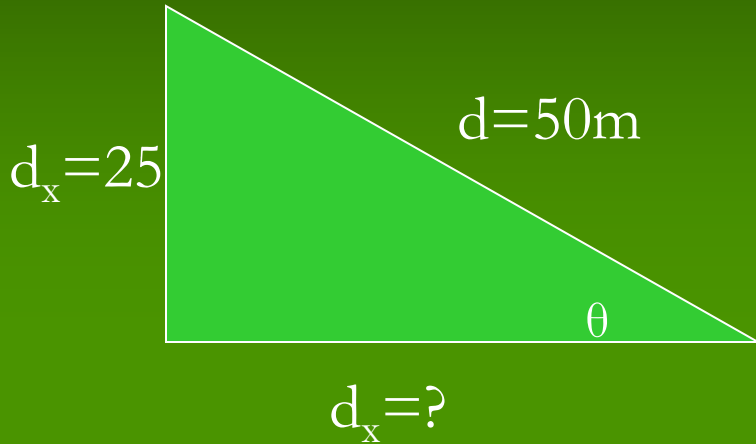
1. $x=300\text{m}$, $y=520\text{m}$
2. $x=520\text{m}$, $y=300\text{m}$
3. $x=8.66\text{m}$, $y=5\text{m}$
4. $x=5\text{m}$, $y=8.66\text{m}$



Inverse Trig Functions

- When solving for an unknown angle you must do the opposite of taking the sin, cos, or tan of an angle.
- The opposite of these functions are \sin^{-1} , \cos^{-1} , \tan^{-1}
- Example:
 $\sin \theta = 3/5$ then $\theta = \sin^{-1}(3/5)$ so $\theta = 36.8^\circ$
- The same rules apply for cosine and tangent.

Trig Practice



Practice Problem

- Joe walks 60m east and then 80m north. Find the magnitude and **direction** of Joe's displacement.

Practice Problem

- A boat is motoring from the west side to the east side of a river. The velocity of the boat is 17m/s . The current of the river flows towards the south with a speed of 8m/s .
- In what direction is the boat traveling?
- How fast would the boat move if the river were perfectly still?

Lesson #16

Topic: Acceleration and Vector Exam Review

Objectives: (After this class I will be able to)

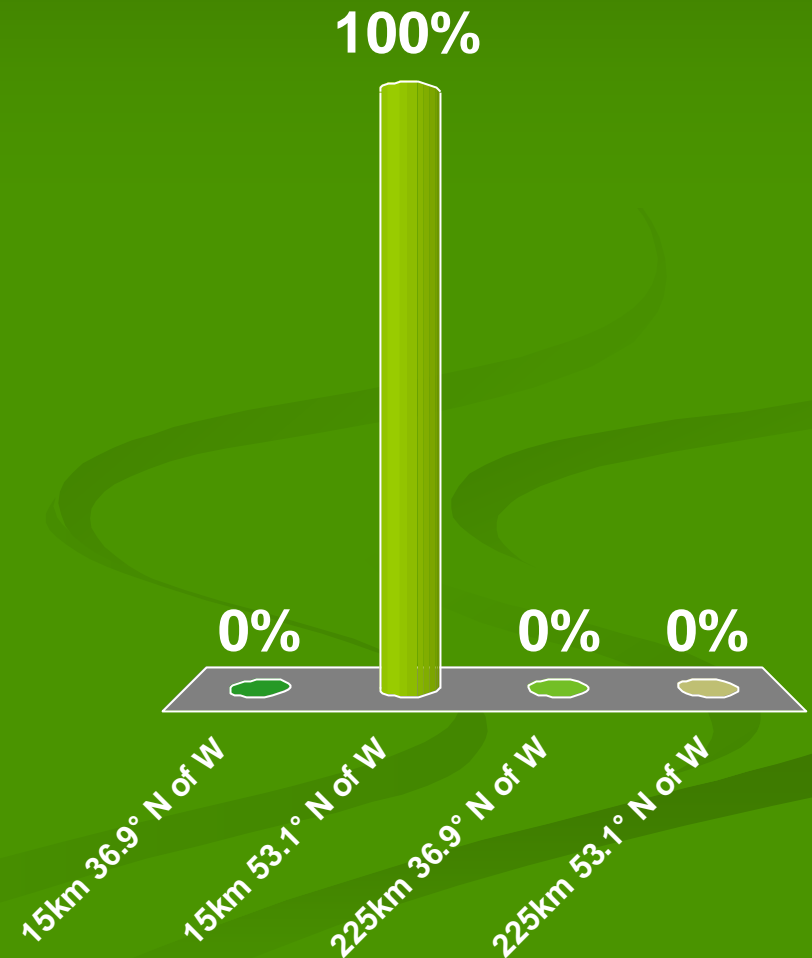
1. Practice solving physics problems
2. Complete and check Exam 2 Review
3. Plan a tutoring time (if needed)
4. Complete a bonus problem opportunity

Warm Up: Jim drives 9km West and then turns North and drives 12 km. Find the magnitude and direction of Jim's displacement.

Assignment: Exam 2 Review Due Wednesday!
Study for Exam 2

Jim drives 9km West and then turns North and drives 12 km. Find the magnitude and direction of Jim's displacement.

1. 15km 36.9° N of W
2. 15km 53.1° N of W
3. 225km 36.9° N of W
4. 225km 53.1° N of W

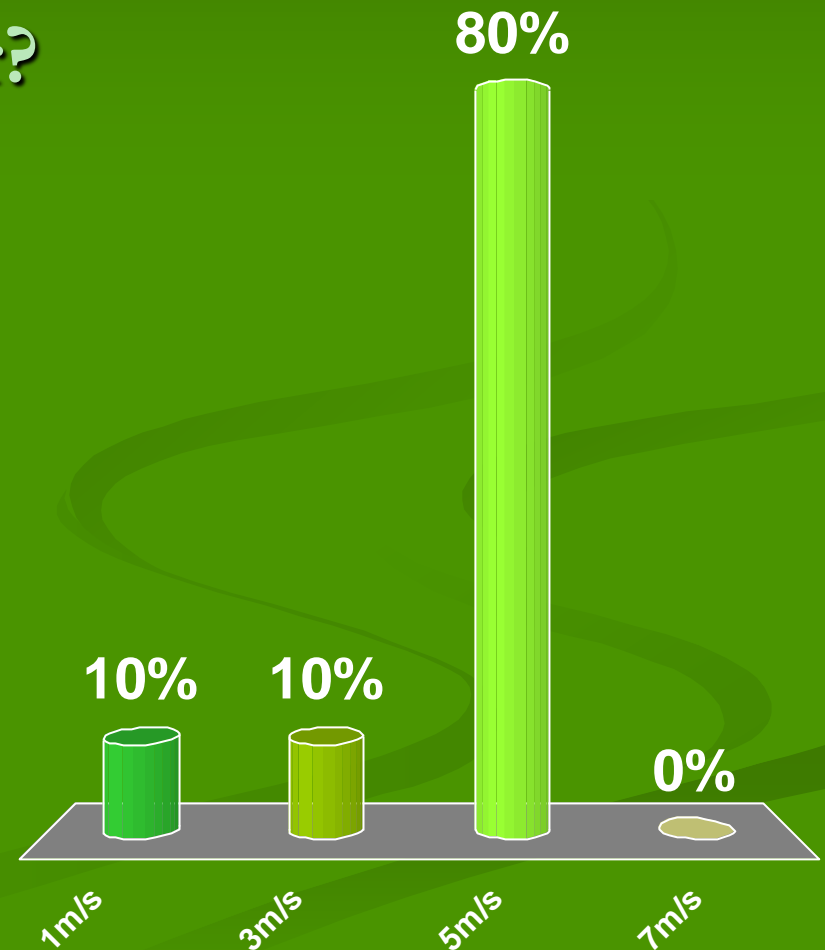


Concepts

- What is gravity?
- What does gravity depend on?
- What can you say about two objects released at the same time?
- What is an example of vertical acceleration?
- What is an example of non-vertical acceleration?

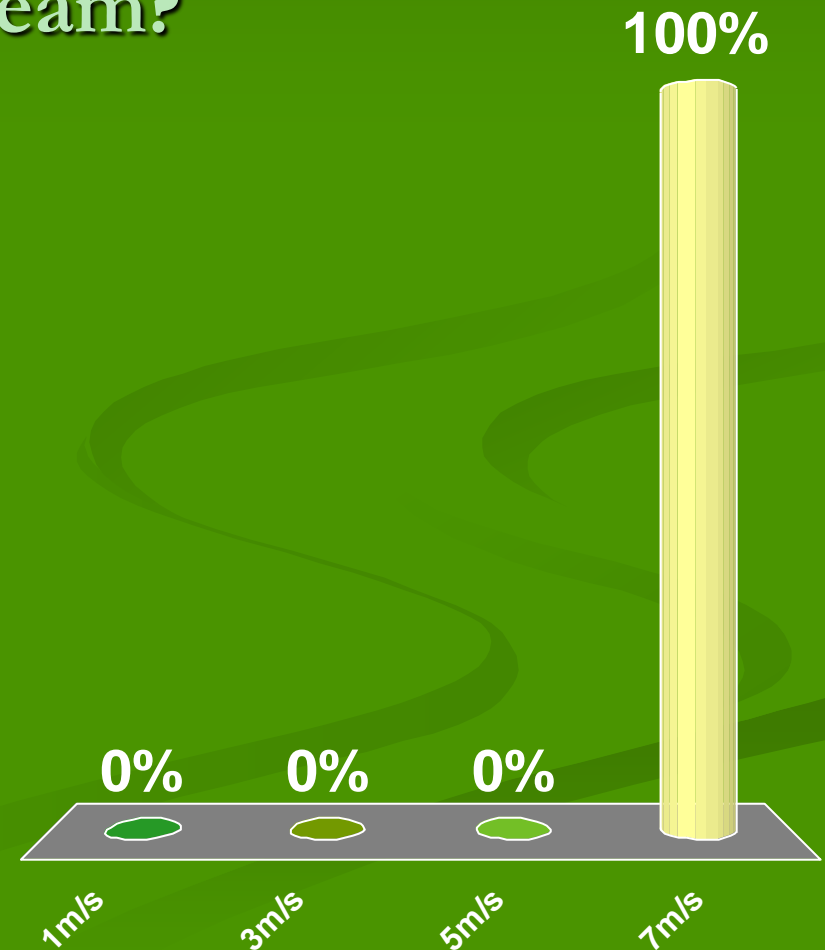
A river boat is traveling upstream with a speed of 3m/s . The river has a current of 2m/s . How fast would the boat move on still water?

1. 1m/s
2. 3m/s
3. 5m/s
4. 7m/s



A river boat is traveling upstream with a speed of 3m/s . The river has a current of 2m/s . How fast would the boat move downstream?

1. 1m/s
2. 3m/s
3. 5m/s
4. 7m/s



Gravity practice

- A stone is thrown vertically upward with an initial velocity of 18m/s .
- How long is the stone in the air?
- How high does the stone go above the ground?
- Make a velocity vs. time graph of the stone's motion.

Bonus 2pts each

1. Eli finds a map for a buried treasure. It tells him to begin at the old oak and walk 21 paces due west, 41 paces and an angle 45° south of west, 69 paces due north, 20 paces due east, and 50 paces at an angle of 53° south of east. How far and what direction from the oak tree is the buried treasure?
2. Veronica can swim 3m/s in still water. While trying to swim directly across a river from west to east, Veronica is pulled by a current flowing southward at 2m/s . What is the magnitude of her resultant velocity? If she wants to end up directly across stream from where she began, at what angle to the shore must she swim upstream?